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## Perpetual Motion: Still Going Around

By Robert L. Park

Special to The Washington Post  
 Wednesday, January 12, 2000; Page H03

"Every one of you can be disconnected from the central power grid and never pay another electric bill as long as you live!" That's what Dennis Lee promised an audience of several hundred in the gymnasium of a rural high school near Columbus, Ohio, earlier this year.

They were there, and I was there, because of a full-page ad in USA Today. In letters two inches tall, its headline asked:

Tired of High Electric Bills . . . How About NO Electric Bills?

Columbus was just one stop on a tour of 45 cities across the nation to demonstrate the revolutionary new technology that Lee says can provide infinite free electricity. The centerpiece of his three-hour presentation was an odd-looking contraption of belts and pulleys that he calls "counter-rotation technology."

He says it makes use of something called the "Fourth Law of Motion." Presumably, that allows his gizmo to evade the limitations of Newton's Third Law of Motion -- for every action, there is an equal and opposite reaction.

According to Lee, counter-rotation technology, combined with "permanent magnet motors that are more than 200 percent efficient," can produce infinite free electricity.

But there is no Fourth Law of Motion. And a machine that produces more energy than it is required to run it would violate the most fundamental law of physics, the conservation of energy.

Lee is something of a throwback in the free energy game. The various schemes that his company, Better World Technologies, Inc., has promoted over the years are classical perpetual motion devices from a bygone era.

They rely not on exotic new physics but on a misunderstanding of centuries-old physics -- Isaac Newton's laws of motion and Michael Faraday's laws of electromagnetism, among others. Nonetheless, despite centuries of evidence to the contrary, such claims still have the power to bamboozle and have been doing so for a long time.

## An Old Dream

In 1618, a London physician named Robert Fludd thought that he had a way to turn a water wheel without depending on nature to provide a millstream. He would use the wheel's rotation to drive a water pump. The water that had turned the wheel would be pumped back to the top, where it could fall again. A mill powered by this device would run indefinitely.

Alas, the amount of energy supplied by a water wheel cannot exceed the weight of the water that hits its paddles multiplied by the distance the water descends in turning the wheel. It would take the same amount of energy to raise the water back to the top of the wheel as the falling water produced in the first place. No energy would be left to grind flour.

Of course, the concept of energy or "work" as a measurable quantity did not exist in the 17th century. Fludd's idea failed, but his failure led others to one of history's greatest scientific insights and helped to pave the way for the industrial revolution.

It would be another 200 years before the flaw in Fludd's machine would be stated in the form of a fundamental law of nature: Energy is neither created nor destroyed. But it is conserved. That is, there is always exactly the same amount of total energy around after something happens than there was before it happened.

Written as a mathematical equation, that is known as the First Law of Thermodynamics. There is no firmer pillar of modern science. It explains why a ball, no matter what it's made of, can never bounce higher than the point from which it's dropped. That's consistent with our everyday experience: You can't get something for nothing.

## But Wait, There's More

Even if it ground no flour, Fludd's water wheel still could not be kept turning. Energy losses, including the heat generated by friction in the machinery, are inevitable. That's embodied in the Second Law of Thermodynamics. Our bouncing ball can never bounce quite as high as the point from which it was dropped.

The first law says you can't win; the second law says you can't even break even.

In the 400 years since Fludd's failure, thousands of inventors have tried to beat the laws of thermodynamics. The laws always won. In frustration, and perhaps embarrassment, many inventors have resorted to fraud, constructing complex devices with cleverly concealed sources of energy. Each failure, each fraud exposed, established the laws of thermodynamics more firmly.

In 1911, the U.S. patent commissioner, exasperated by the time wasted on these impossible ideas, ruled that patent applications for

perpetual motion machines could not be submitted until one year after an operating model was filed with the patent office.

If the machine was still running at the end of the year, the application would be accepted. The new ruling seemed to bring an end to patent applications for perpetual motion machines.

In 1983, however, Joseph Newman, a mechanic from Lucedale, Miss., sought to patent an "energy machine" that he said produced more energy than was needed to run it. Newman insisted that his invention was not a perpetual motion machine and asserted that the energy came from conversion of mass into energy according to Einstein's famous equation  $E = mc^2$ . Nuclear power comes from this conversion, but Newman's was not nuclear power.

Slowly, Newman said, his machine was devouring its own copper wires and iron magnets. Because  $c^2$  (the speed of light squared) is such a huge number, his machine would, for all practical purposes, last forever.

Unimpressed, the patent examiner rejected Newman's application. Not a man to be pushed around, Newman filed suit in federal court to force the Patent and Trademark Office to grant a patent for "an unlimited source of energy."

Could Joe Newman, a simple mechanic, have discovered a way to convert copper and iron into electrical energy? A federal judge ordered Newman to turn his energy machine over to what then was called the National Bureau of Standards for testing. Properly measured, the output power was found to be much less than the input power. Newman lost his suit.

But his failure, like that of Fludd, made a contribution. His suit, *Newman v. Quigg* now is cited as the legal justification for rejecting all patent applications involving perpetual motion. The conservation of energy thus became the law of the land as well as a law of nature.

### Beating the System

Nonetheless, plenty of people still claim to have discovered infinite sources of free energy. Indeed, a worldwide network of passionate free energy believers resides just beyond the fringes of the scientific community.

These people generally shun old-fashioned terms such as "perpetual motion." Instead, they speak a language laced with words and symbols drawn from modern cosmology and atomic physics. They may even believe it to be science, just as witches and faith healers may truly believe that they can summon supernatural powers.

Ignored or even ridiculed by other scientists, they dream of redemption when the world finally realizes the truth. They even have their own magazine, *Infinite Energy*, which fills its pages with rosy stories about progress in the quest for free energy, particularly cold fusion. The progress is hard for a nonbeliever to see.

Nevertheless, these claims attract investors.

For example, BlackLight Power of Princeton, N.J., raised \$10 million from power companies on the word of its founder, Randall Mills, that he had discovered a way to produce inexhaustible, low-cost, non-polluting energy from ordinary water. The method: shrinking the hydrogen atoms into an energy state below their ground state. He calls these shrunken hydrogen atoms "hydrinos."

Atoms can absorb energy, much as energy is stored in the spring of an alarm clock when you wind it. As the clock ticks, the energy is released bit by bit in sound waves, friction and the motion of the clockworks. When the clock is fully wound down, a physicist would say it's in its "ground state" -- the state of lowest energy. A state below the ground state is a contradiction of terms.

Mills, whose degree is in medicine and who has no record of accomplishment in physics, describes this as "the most important discovery of all time . . . up there with fire." Could he be right? Could there be a state of hydrogen that other scientists had missed?

No.

The energy states of atoms are studied through their atomic spectra -- light emitted at very specific wavelengths when electrons make a jump from one energy level to another. The exact prediction of the hydrogen spectrum was one of the first great triumphs of quantum theory; it is the platform on which our entire understanding of atomic physics is built. The theory accounts perfectly for every spectral line.

There is no line corresponding to a "hydrino" state. Indeed, there is no credible evidence at all to support Mills' claim.

### Weighty Matters

So many companies are claiming to have discovered free energy that additional claims are needed to set one apart from the competition.

James Patterson, an avuncular, white-haired 75-year-old who complains that his wonderful discoveries take time from fishing, says he also can produce unlimited, non-polluting energy from ordinary water with a device similar to the electrolytic cells of BlackLight Power. But he says the Patterson Power Cell also neutralizes radioactivity.

It would be difficult to find a nuclear physicist who would take such a claim seriously. The only way to neutralize radioactivity, to the extent that it can be done at all, is with a nuclear reactor or a powerful nuclear accelerator. Still, Patterson's company, Clean Energy Technologies, Inc., did well for a time after he appeared on ABC's "Good Morning America" in 1996 and again in 1997.

The problem is that we all want to see miracles. Perhaps scientists do more than others. Many of them were drawn to science by its promise

of miracles. Miracles do occur, more all the time, or at least scientific advances that would have seemed like miracles a few years ago. Besides, who could blame venture capitalists for investing in hydrinos when NASA scientists are investing in gravity shields?

NASA has invested about \$1 million to test the 1992 claim of a Russian physicist, Eugene Podkletnov, that objects placed above a spinning superconductive disk showed a decrease in weight of about 2 percent.

Superconductors are materials, in this case a ceramic, that lose all resistance to electric currents when cooled below a critical temperature. Could the Podkletnov gravity shield be another miracle?

"Let your imagination run wild," a NASA spokesman advised in an interview this year with *The Columbus Dispatch*. "What could you do if you could cut gravity by 50 percent or negate gravity altogether?"

Well, for one thing, you could build a perpetual motion machine. If Robert Fludd had had a gravity shield, he could have raised the water back to the top of the wheel with less energy than the wheel would generate. All that was missing was the shield.

It's still missing.

NASA has tested one Podkletnov shield. Researchers measured a weight change of only 2 parts per million. Any weight reduction would be a revolutionary discovery, but the researchers noted that such a minuscule effect is at the limit of their measurement accuracy.

Podkletnov was brought to the United States to see whether he could help. He said he was puzzled, that it worked for him. But maybe NASA needed a bigger disk. That's what's happening now; they are building a bigger shield.

You can view this two ways: Either you accept the First Law of Thermodynamics, in which case the fact that a gravity shield would let you build a perpetual motion machine becomes proof that such a shield is impossible, or you figure that the First Law might be wrong and begin searching for a gravity shield.

NASA scientists chose the second option. They are betting against the laws of thermodynamics. No one wins that wager.

The gravity shield motor is the simplest example of an unbalanced-wheel perpetual motion machine. There have been hundreds of attempts to build perpetual motion machines that would run off the force of gravity, relying on complicated schemes for shifting weight from one side of a wheel to the other as it turns.

But shifting the weight always costs more energy than the wheel supplies. That was the problem with Fludd's water wheel.

It's also the problem with another another class of perpetual motion

machines that supposedly extract energy from their surroundings. These usually involve a fluid that vaporizes readily at room temperature. The pressure exerted by the expanding vapor is used to drive a piston.

Such machines violate the Second Law of Thermodynamics. It also takes energy to cool the vapor back into the liquid state so it can power a second stroke of the piston. And that takes more energy than the piston can supply.

Dennis Lee was featuring such a machine two years ago when I saw his show in Hackensack, N.J. He called it the "Fisher engine" and described it as the "most important discovery in mechanical history."

Actually, it was an old idea. A remarkably similar machine was sold to the Navy in 1880 by John Gamgee, a professor who called it the "zeromotor." It didn't work then either.

Another popular notion involves devices that somehow can rearrange and condense energy from a wide area to a smaller one, where it can be put to use. This is a hugely appealing idea. After all, there's enough heat energy in the average snowbank to heat your home for quite a while; it just happens to be distributed in inconveniently tiny amounts throughout billions of snowflakes and air pockets.

Even if it could all be gathered, it would take a great deal of energy to do so -- more than you could ever extract from the snow.

Still, an ambient-heat engine recently was described in a full page ad in *Physics Today*, the monthly magazine of the physics community, by a company called Entropy Systems Inc. Physicists who took time to read the ad were either outraged or incapacitated with laughter.

If the authors of the ad had any intention of bamboozling readers, they chose an unlikely publication in which to make their pitch.

It never pays to underestimate the human capacity for self-deception, but at some point, those who claim to have discovered a source of free energy must begin to realize that things aren't working as they expected.

They are faced with a choice. In one direction lies acknowledgment that perhaps they've made a mistake. The more publicly and forcefully they have pressed their claim, the more difficult it will be to take that road.

In the other direction is denial. The farther they travel that road, the less likely it becomes that they will ever turn back. This is the road to fraud because no matter how many laws they've broken by that time, they cannot break the laws of physics.

Robert L. Park, professor of physics at the University of Maryland, is the author of the forthcoming book, *Voodoo Science: The Road from Foolishness to Fraud* (Oxford University Press).